5.5.7 Personal background

> "Die Nachbeterei der Kompendien war mir bald zuwider und ihre beschränkte Einförmigkeit gar zu auffallend."
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> *Johann Wolfgang Goethe: Farbenlehre, historischer Teil: Konfession des Verfassers (1999/98; GA 16/713).*

The present investigation is the result of an effort lasting for more than fifty years and mostly devoted to elementary applied mechanics, motions and propulsion of bodies in fluids, marine vehicles in particular. It is a very personal attempt, to understand the factual and 'fictional' implications of all our fundamental mechanical theories by way of reconstructing them and thus to provide an adequate foundation for practical applications, non-traditional and non-routine applications in particular.

This foundation the author found missing in all texts on the theory, on the philosophy and on the history of mechanics he got hold of and could possibly digest. In this search found (Popper, 1976/16):

> "My own attitude towards such problems remained the same for a long time. I never thought it possible that any of those which bothered me had not been solved long ago; even less that any of them could be new. I had no doubt that people .... would know all the answers. My difficulties, I thought, were entirely due to my limited understanding."

This personal aspect is not considered as a drawback, but as an essential part of the story as explained by Daston (2001/20):

> "Ich will in diesen beiden Aufsätzen [papers 3 and 6 of the collection] zeigen, daß die emotionalen und moralischen Aspekte der Wissenschaft nicht nur akzidentelle Begleiterscheinungen sind. Denn kognitive Leidenschaft und moralische Ökonomie wirken mit, wenn es darum geht, was erforscht werden soll, wie geforscht werden soll und wann man sich mit einer Erklärung zufrieden gibt – daher sind sie integraler Bestandteil der Wissenschaft, wie sie wirklich betrieben wird."

The author gratefully acknowledges the impact made by his teachers at the Sachsenwald-Oberschule at Reinbek, where he received his introduction into classical German literature by Dorothea Koeppen and his basic training in Mathematics and Physics by Kurt Zita.

After having got over the intellectual measles, trying very hard to trisect an angle, he knew how important proofs of existence or, even more important, of non-existence of solutions are. And in a thesis 'On Envelopes of Plane Curves' based on Felix Klein's 'Geometry from an Advanced Standpoint' (1948) he learned to embed problems into more general contexts.

The fascination by axiomatic systems and conventions in the spirit of Hilbert and Poincaré[H] has been the basis of playful, joyful, though still vague visions of science shared with the classmate Rudolf Mosch. The early inherited, inherent interest and the firm instinctive belief in the power of 'Formalismus', so our password, has dominated the author's entire professional work.

It provided the tool for the independent solution of old problems in Goethe's sense, in permitting the unobstructed look onto the essentials and their pragmatic reconstruction in 'praktischen und sich selbst rektifizierenden Operationen des gemeinen Menschenverstandes, der sich in einer höhern Sphäre zu üben wagt'.

At the Technical University Braunschweig in 1952/54 the author received his fundamental undergraduate training in Mechanics by Hermann Schäfer and Sigurd Falk[S], in Hydromechanics by Hermann Schlichting, in Thermodynamics and Chemical Kinetics by Fran Bosnjacovic, and, last but not least, in Philosophy by Herrmann Glockner, the 'Hegel-Glockner', explaining the necessary aspects of real objects in our world: rationality, phenomenality and individuality.

At the Technical University Berlin 1954/58 he was first exposed to the Theory of Ships by Fritz Horn and Hans Amtsberg and to the Theory of Diesel Engines by Friedrich Sass, who 'knew' that forces act 'in bodies only'.

In the lectures on Advanced Thermodynamics of Hans-Günther Kayser[HG] and in writing a thesis 'On the Possibilities of a Rational Theory of Continuous, Heterogeneous Combustion of Liquid Fuels' he finally understood the atomistic foundation of macroscopic concepts of temperature and entropy, following the ideas of Clausius, Maxwell and Boltzmann, and, maybe even more important, the implications of the balance of quantities.

This training has been continued, thanks to a scholarship granted by the Studienstiftung des Deutschen Volkes, during a post-graduate course on 'Boundary Layers, Heat Transfer and Combustion' at the Imperial College in London 1958/59. Most impressive have been the lectures and the guidance of D. Brian Spalding, in particular his rigorous criticism of the author's thesis 'On the Factual and Logical Implications of a Macroscopic Theory of Rate Processes in Continuous, Isotropic Systems', which may be considered as the earliest fore-runner of this treatise.

Since 1959 until 1997 the author has been scientific officer in various positions at the Versuchsanstalt für Wasserbau und Schiffbau, VWS, the Berlin Model Basin, mostly under the directorship of Siegfried Schuster, who provided for an environment in which non-traditional ideas could be tested and published, not only at VWS but also during leaves of absence generously granted.

The integral balance of quantities has been applied in the doctoral thesis 1962 on 'A general Equation for the Motions of Rigid Bodies in Fluids', and has been further developed during a Max-Kade-Research Fellowship at the MIT in 1968/69 in post-doctoral studies on systems identification, resulting in a thesis on the 'Design and Evaluation of Experiments for the Identification of Physical Systems'.

During a Visiting Professorship at the University of Tokyo in 1973 studies in modelling have been instrumental in understanding what we do. The resulting thesis 'On State Space Models and Their Application to Hydromechanic Systems', based on Wymore's 'A Mathematical Theory of Systems Engineering: the Elements' (1967), is an operational model of Plato's parable of the prisoners in the cave, the fundamental metaphysics of this treatise.

In a paper on 'An Axiomatic Theory of the Interaction between Ship Hull and Propeller' 1980 the author finally became aware of the conventional, normative nature of all our work and has since been developing not only the rational theory of ship propulsion and its applications, but the rational theory of science and its application to classical mechanics.

In all practical developments and applications of the ideas algorithmic languages and computers have been instrumental, starting with intensive use of ALGOL on Zuse's Z 23. Strongly influenced by the structure of ALGOL (Baumann, 1969) in all this work the explicit creation of adequate coherent formal languages played a constitutive role.

The interest in this aspect of my work dates back to school days as mentioned earlier and the professional experience has been the basis of participation in and contributions to international terminology work, summarised in 'Some Fundamental Considerations Concerning the History and Recent Development of the ITTC SaT List, the International Towing Tank Conference Symbols and Terminology List'.

All these ideas had immediate applications and they have been 'proved' to be very powerful and have been further developed in my daily work at the Versuchsanstalt für Wasserbau und Schiffbau, the Berlin Model Basin, lasting over nearly forty years. During that time my colleague Rüdiger Snay has always been a creative partner, generating ideas and contributing solutions based on his sound feeling for mechanics.

And all these ideas have been further developed in my lectures on the 'Principles, Methods and Problems in Hydromechanical Systems Engineering' held as ausserplanmässiger (apl.) Professor at the Technical University Berlin for more than twenty-five years and after retirement still being held.

In any particular case it took very nearly exactly ten years from the first contact with a problem, noticing that there is a problem, to its solution. This

observation is in agreement with a general rule: 'The 10-year[s] rule states that it takes approximately a decade of heavy labor to master any field.' (Ross, 2006/68; 2007/41).

As a whole the development was very similar to Goethe's 'Verhältnis zur Wissenschaft' (1960/272-273):

> "Man gewöhnt uns von Jugend auf, die Wissenschaften als Objekte anzusehen, die wir uns zueignen, nutzen, beherrschen können.
>
> Ohne diesen Glauben würde niemand etwas lernen wollen. Und doch behandelt jeder die Wissenschaften nach seinem Charakter.
>
> Der junge Mann verlangt Gewißheit, verlangt didaktischen, dogmatischen Vortrag.
>
> Kommt man tiefer in die Sache, so sieht man, wie eigentlich das Subjektive auch in den Wissenschaften waltet, und man prosperiert nicht eher, als bis man anfängt, sich selbst und seinen Charakter kennenzulernen.
>
> Da nun aber unser Individuum, es sei so entschieden als es wolle, doch von der Zeit abhängt, wohin es gesetzt, von dem Ort, wohin es gestellt ist, so haben diese Zufälligkeiten Einfluß auf das notwendig Gegebene.
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> Zu diesen Betrachtungen ward ich besonders aufgefordert, da ich aus Neigung und zu praktischen Zwecken mich in das wissenschaftliche Feld begeben, zu gewissen Überzeugungen gelangt, denselben nachgegangen bin, wodurch sich denn endlich eine gewisse Denkweise bei mir bildete und festsetzte, wonach ich die Gegenstände schätzte und beurteilte.
>
> So nahm ich auf, was mir gemäß war, lehnte ab, was mich störte, und da ich öffentlich zu lehren nicht nötig hatte, belehrt ich mich auf meine eigene Weise, ohne mich nach irgend etwas Gegebenem oder Herkömmlichem zu richten.
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> Deswegen konnt ich jede neue Entdeckung freudig aufnehmen und was ich selbst gewahr ward ausbilden. Das Vorteilhafte kam mir zugute, und das Widerwärtige brauchte ich nicht zu achten.
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> Nun aber ist in den Wissenschaften ein ewiger Kreislauf; nicht daß die Gegenstände sich änderten, sondern daß bei neuen Erfahrungen jeder Einzelne in den Fall gesetzt wird, sich selbst geltend zu machen, Wissen und Wissenschaften nach seiner eigenen Weise zu behandeln.
>
> Weil nun aber die menschlichen Denkweisen auch in einen gewissen Zirkel eingeschlossen sind, so kommen die Methoden bei der Umkehrung immer wieder auf die alte Seite; atomistische und dynamische Vorstellungen werden immer wechseln, aber nur a posteriori, denn keine vertritt die andere ganz und gar, nicht einmal ein Individuum, denn der entschiedenste Dynamiker wird, ehe er sichs versieht, atomistisch reden, und so kann sich auch der Atomiste nicht dergestalt abschließen, daß er nicht hie und da dynamisch werden sollte."